# Sampling Results for the Conditional Waiver for Irrigated Agriculture Phase II Monitoring Program – Central Valley Regional Water Quality Control Board

**Quarterly Report – Activities from April 1, 2005 – June 30, 2005**

**Prepared for the Central Valley Regional Water Quality Control Board**

**By**

**Aquatic Ecosystems Analysis Laboratory**
**John Muir Institute of the Environment**
**University of California, Davis**

**Michael L. Johnson**
**Anja B. Wehrmann**
**Stephanie N. Chun**

**June 30, 2005**

## Sediment sampling for dormant season 2004 / 2005

Fifteen sites were sampled for sediment toxicity by UC Davis in collaboration with Donald Weston from UC Berkeley (Table 1). NSJ31 and SED12 were dry; sediment samples were collected from the 13 remaining locations.

No sampling was conducted between February 24th and June 12th 2005. Activities during the quarter included preparation for the irrigation season sampling 2005, data base development and reporting.

**Table 1. Ag Waiver dormant season 2004 / 2005 sites sampled for Sediment Toxicity**

| Site ID | Site Name | Latitude | Longitude |
|---|---|---|---|
| CS07 | Butte Creek on Durham Dayton Hwy | 39.64599 | 121.78557 |
| CS15 | Spring Creek at Walnut Drive | 39.11980 | 122.19419 |
| SED11 | Drain on Sarale Farms at Bonetti Drive | 37.86074 | 121.51990 |
| NSJ28 | Drain to Pixley Slough at 8-mile Rd. | 38.05752 | 121.31521 |
| NSJ31 | Calaveras River at Pezzi Rd | 38.04536 | 121.19982 |
| NSJ32 | Bear Creek at Alpine Rd | 38.07383 | 121.21217 |
| SS06 | Winters Canal at Road 86A | 38.66355 | 122.01747 |
| SSJ03 | Berenda Creek near intersection of Rd 17 and Ave 17.5 west of Madera | 37.00500 | 120.23791 |
| SSJ12 | Duck Slough at Arboleda Drive | 37.25720 | 120.37912 |
| SED12 | Hospital Creek @ Rd 33 | 37.60446 | 121.25806 |
| NSJ18 | Orestimba @ Kilburn Rd | 37.39929 | 121.03259 |
| SED27 | Stony Creek @ Hwy 32 | 39.74592 | 122.10140 |
| SED28 | Colusa Drain @ Hwy 162 | 39.52204 | 122.04568 |
| SED29 | Big Chico Creek @ Grape Way | 39.71602 | 121.93142 |
| SED30 | Mud Creek @ Meridian Rd | 39.74762 | 121.91923 |



## Preparation for irrigation season sampling

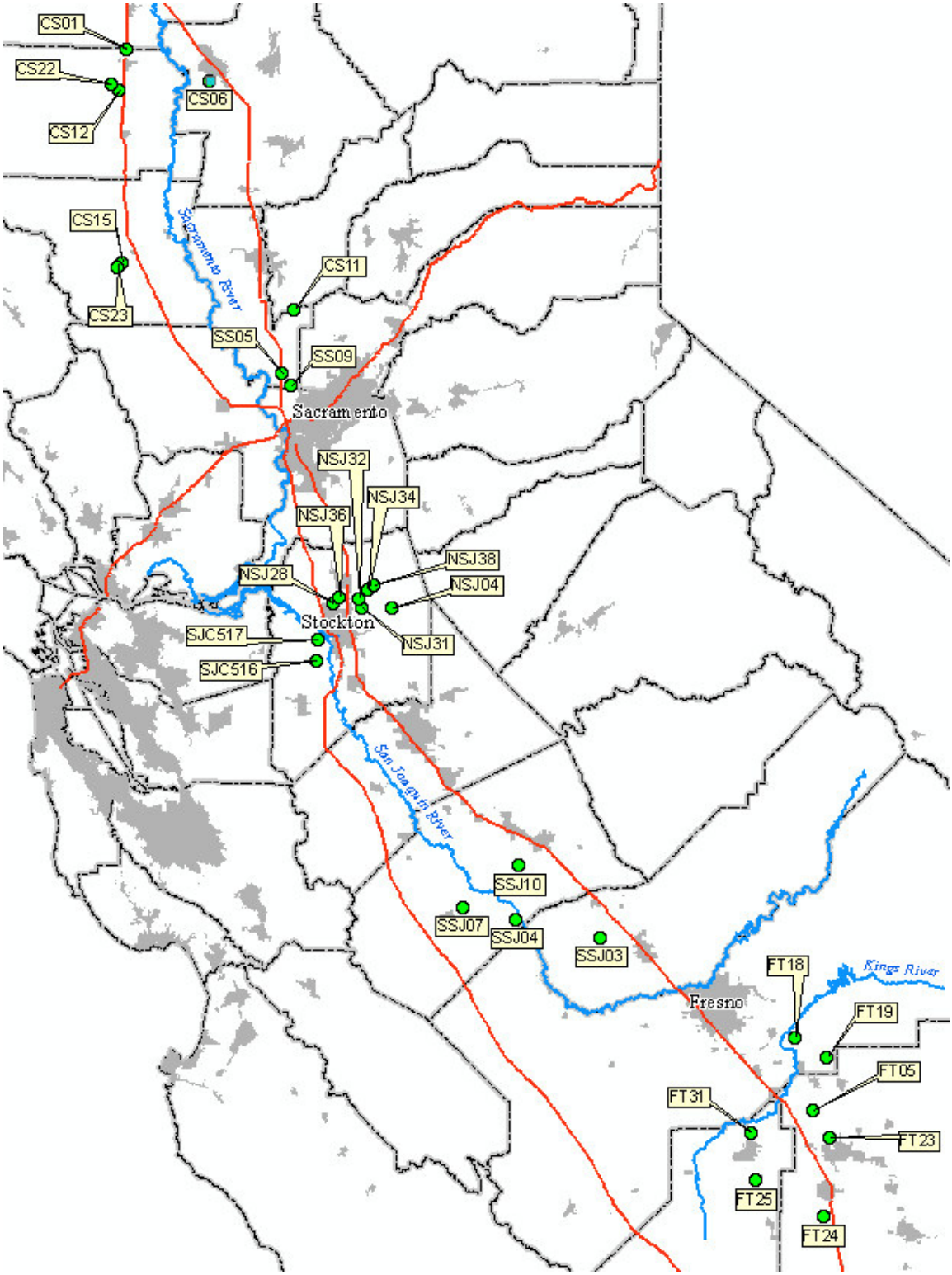
UC Davis met with staff from the Irrigated Lands Unit at the Central Valley Regional Water Quality Control Board in early May to discuss the previous sampling and the upcoming irrigation season. UC Davis compiled a table of site suggestions for the 2005 irrigation season, based on sampling results acquired during the previous irrigation and dormant seasons. The site suggestions highlighted previous sites that had toxic hits, potential sites located upstream of these sites, and potential new sites. Additional Fresno-Tulare sites were scouted and added to the list by the Regional Board staff. Two additional sites were included because of the availability of additional water quality data from other Regional Board programs. After review by the Regional Board, the candidate sites were narrowed down and UC Davis and Regional Board staff visited potential upstream and new sites in May and June.

A total of 29 sites were selected for sampling (Table 2, Figure 1), and the following constituents were designated for collection during the first two rounds of sampling (June 13-July 7) by the Regional Board: physical parameters, nutrients, total organic carbon, water column toxicity, metals, hardness, and pesticides (organochlorines, organophosphates, carbamates, pyrethroids, and herbicides).

UC Davis prepared for the upcoming sampling season by ordering supplies (i.e. bottles, gloves, etc.) and designing and preparing data sheets and labels. New maps and site information were compiled, and sampling and Quality Control schedules were created for the sites. During late May through early June, all field personnel were provided refresher training on sampling techniques and how to complete data sheets for the new season.

After the first round of sampling concluded on June 22, a follow up meeting between the Regional Board, UC Davis, CDFG, and AquaScience occurred on June 24. A summary from the first two weeks of sampling and preliminary toxicity results were presented and discussed.

Figure 1. Distribution of sites selected for sampling during the summer 2005 irrigation season.



## Table 2. Sampling Sites, UC DAVIS Phase II Contract, 2005 Irrigation Season

| Site ID | Site name | County | Suggested by | Rationale |
|---|---|---|---|---|
| CS01 | Drain to Home Colony Canal at County Rd 99w | Tehama/Glenn | UCD | Not previously sampled. Olives, vineyards, pasture, field crops. |
| CS12 | Drain to Walker Creek at Co Rd 28 | Glenn | UCD | Toxic event during '04 irrigation season (0% survival of Ceriodaphnia). 8 OP pesticide detections. Resample CS12 and sample upstream. |
| CS15 | Spring Creek at Walnut Drive. | Colusa | UCD | Four events of 0% survival of Ceriodaphnia (irrigation and dormant events). Many OP pesticide detections. Resample and sample upstream. |
| CS22 | Drain to Walker Creek at Co Rd D | Glenn | UCD | Upstream from CS12. Eliminates vineyards, leaves only orchards. |
| CS23 | Spring Creek at E Camp Rd | Colusa | UCD | Upstream from CS15. Eliminates one area of orchard. Not much agriculture upstream. |
| CS06 | Comanche Creek (Angel Slough) at Dayton Rd | Butte | UCD | Not previously sampled. Orchards |
| CS11 | Bear River at Pleasant Grove Rd | Sutter | UCD | Not previously sampled. Orchards. |
| SS05 | North Main Canal at Sankey Rd | Sutter | UCD | Not previously sampled. Rice, cover crops |
| SS09 | N-S Ditch along Natomas Rd | Sutter | UCD | Unidentified toxicity to Ceriodaphnia during one '04 irrigation season event. No upstream available. Resample |
| NSJ04 | Calaveras River at Clements Rd | San Joaquin | UCD | Upstream from NSJ31. Walnut orchards, rangeland. |
| NSJ31 | Calaveras River at Pezzi Rd | San Joaquin | UCD | Resample and sample upstream. Many OP pesticides and herbicides detected. |
| NSJ32 | Bear Creek at Alpine Rd | San Joaquin | UCD | Resample and sample upstream. Many OP pesticides and herbicides detected during dormant season. |
| NSJ34 | Bear Creek at Harney Ln | San Joaquin | UCD | Upstream from NSJ32. Eliminates Paddy Creek. |
| NSJ38 | Paddy Creek at Jack Tone Rd | San Joaquin | UCD | Upstream from NSJ37. |
| NSJ28 | Pixley Slough at Eightmile Rd | San Joaquin | UCD | Resample and sample upstream. Many herbicides and OP pesticides, especially during dormant season. |
| NSJ36 | Pixley Slough at Ham Ln | San Joaquin | UCD | Upstream from NSJ33 (NSJ33 was not safe for sampling). |
| SJC516 | Canal at Howard Rd. east of Stark Rd | San Joaquin | Jay Rowan | Supports bioassessment study. Lat 37.87696. Long 121.37656 |
| SJC517 | Mid Roberts Island Drain at Woodsbro | San Joaquin | Jay Rowan | Supports bioassessment study. Lat 37.94163 Long 121.3693 |
| FT18 | Drain to Fink Ditch at Central Ave | Fresno | RB5F | Not previously sampled. Deciduous orchards. Lat 36.69155 Long 119.46542 |

| Site ID | Site name | County | Suggested by | Rationale |
|---|---|---|---|---|
| FT19 | Drain to Wooten Cr along Hill Rd at Wooten Cr | Fresno | RB5F | Not previously sampled Irrigated orange orchards. Lat 36.62847 Long 119.33928 |
| FT23 | St. Johns River at Road 108 | Tulare | RB5F | Not previously sampled. Corn silage, wheat, alfalfa, walnuts, tree fruit. May run dry. Lat 36.37415 Long 119.33225 |
| FT24 | Elk Bayou at Road 96 | Tulare | RB5F | Not previously sampled. Wheat, oats, corn silage, grapes, cotton, deciduous orchards. Lat 36.12415 Long 119.35760 |
| FT05 | Button Ditch on Ave 368 | Tulare | UCD | Resample. Sample upstream? One 0% Ceriodaphnia survival event. |
| FT25 | Melga Canal at Jersey Ave | Kings | RB5F | Not previously sampled. Wheat, oats, corn silage, cotton, dairies. Lat 36.24044 Long 119.62512 |
| FT31 | Peoples Ditch at Elder Ave | Kings | RB5F | Not previously sampled. Good mix of fruit, nuts, wheat, oats, corn silage, cotton. Lat 36.38662 Long 119.63863 |
| SSJ03 | Berenda Creek at Ave 17.5 | | UCD | One 0% Ceriodaphnia event, many pesticides and herbicides detected. Resample and sample upstream. |
| SSJ04 | Island Field Drain on Catrina Rd | Merced | UCD | Not previously sampled. Row crops. |
| SSJ07 | Boundary Drain at Henry Miller Ave | Merced | UCD | Not previously sampled. Cover crops and cotton. |
| SSJ10 | Owens Creek at Gurr Rd | Merced | UCD | Not previously sampled. Irrigated fields. |

The following toxicity results are from the first sampling period (Event 1).

## SUMMARY OF AG WAIVER TOXICITY TESTING RESULTS

### Ag Waiver 05-03 1

| *Sample Date (Test Date)* | *Sample ID* | *Acute Ceriodaphnia (% Survival)* | *Acute Fathead Minnow (% Survival)* | *Algae (Cells/mL)* | *Total $NH_4$ (mg/L)* |
|---|---|---|---|---|---|
| 6/13/05 (6/14/05) | Lab Control | 100 | 97.5 | 286,825 | n/a |
| | CS01 | 100 | 100 | 882,000 | 0.01 |
| | CS12 | 0* [1,2] | 97.5 | 2,355,475 | 0.1 |
| | CS15 | 100 | 95 | 1,100,150 | 0.4 |
| | CS23 | 0* [2,3] | 90 | 1,029,750 | 0.2 |

* = Significantly different from control
1 All dead in 48 hours
2 *Ceriodaphnia* TIE
3 All dead in 24 hours

### Ag Waiver 05-03 2

| *Sample Date (Test Date)* | *Sample ID* | *Acute Ceriodaphnia (% Survival)* | *Acute Fathead Minnow (% Survival)* | *Algae (Cells/mL)* | *Total $NH_4$ (mg/L)* |
|---|---|---|---|---|---|
| 6/14/05 (6/15/05) | Lab Control | 100 | 100 | 320,250 | n/a |
| | CS06 | 95 | 90* | 2,740,625 | 0 |
| | CS11 | 90 | 95 | 3,063,725 | 0 |
| | SS09 | 95 | 95 | 3,133,550 | 1.9 |
| | SS05A | 0* [1,2] | 92.5 | 2,843,100 | 0.3 |
| | SS05B | 0* [1] | 87.5* | 3,139,425 | 0.3 |

* = Significantly different from control
1 All dead in 48 hours
2 *Ceriodaphnia* TIE

## SUMMARY OF AG WAIVER TOXICITY TESTING RESULTS

**Ag Waiver 05-03 3**

| *Sample Date (Test Date)* | *Sample ID* | *Acute Ceriodaphnia (% Survival)* | *Acute Fathead Minnow (% Survival)* | *Algae (Cells/mL)* | *Total $NH_4$ (mg/L)* |
|---|---|---|---|---|---|
| 6/15/05 (6/16/05) | Lab Control | 95 | 100 | 260,625 | n/a |
| | NSJ04 | 95 | 100 | 3,015,700 | 0.1 |
| | NSJ31 | 55* | 100 | 4,013,850 | 0.1 |
| | NSJ32 | 85 | 100 | 765,075 | 0.2 |
| | NSJ34 | 100 | 97.5 | 3,717,425 | 0.3 |
| | NSJ38 | 80 | 100 | 2,808,725 | 0.4 |

* = Significantly different from control

**Ag Waiver 05-03 4**

| *Sample Date (Test Date)* | *Sample ID* | *Acute Ceriodaphnia (% Survival)* | *Acute Fathead Minnow (% Survival)* | *Algae (Cells/mL)* | *Total $NH_4$ (mg/L)* |
|---|---|---|---|---|---|
| 6/16/05 (6/17/05) | Lab Control | 100 | 95 | 368,125 | n/a |
| | NSJ28A | 95 | 92.5 | 5,623,375 | 0.2 |
| | NSJ28B | 100 | 90 | 483,825 | 0.0 |
| | NSJ36 | 100 | 90 | 5,867,575 | 0.2 |
| | SJC516 | 100 | 100 | 5,752,425 | 1.0 |

* = Significantly different from control

## SUMMARY OF AG WAIVER TOXICITY TESTING RESULTS

**Ag Waiver 05-03 5**

| *Sample Date (Test Date)* | *Sample ID* | *Acute Ceriodaphnia (% Survival)* | *Acute Fathead Minnow (% Survival)* | *Algae (Cells/mL)* | *Total $NH_4$ (mg/L)* |
|---|---|---|---|---|---|
| 6/20/05 (6/21/05) | Lab Control | 100 | 97 | 270,525 | -- |
| | FT05 | 100 | 82.5* | 4,260,000 | 0.3 |
| | FT18 | 100 | 95 | 4,388,525 | 0.2 |
| | FT19 | 100 | 93 | 3,164,450 | 0.2 |
| | FT25 | 100 | 87.2 | 4,405,075 | 0.3 |
| | FT31 | 100 | 87.5 | 4,521,125 | 0.3 |

* = Significantly different from control

**Ag Waiver 05-03 6**

| *Sample Date (Test Date)* | *Sample ID* | *Acute Ceriodaphnia (% Survival)* | *Acute Fathead Minnow (% Survival)* | *Algae (Cells/mL)* | *Total $NH_4$ (mg/L)* |
|---|---|---|---|---|---|
| 6/21/05 (6/22/05) | Lab Control | 100 | 100 | 252,500 | -- |
| | FT23 | 100 | 92.5 | 4,810,850 | 0.0 |
| | FT24 | 100 | 92.5* | 4,978,525 | 0.2 |

* = Significantly different from control

## SUMMARY OF AG WAIVER TOXICITY TESTING RESULTS

**Ag Waiver 05-03 7**

| *Sample Date (Test Date)* | *Sample ID* | *Acute Ceriodaphnia (% Survival)* | *Acute Fathead Minnow (% Survival)* | *Algae (Cells/mL)* | *Total $NH_4$ (mg/L)* |
|---|---|---|---|---|---|
| 6/22/05 (6/23/05) | Lab Control | 100 | 95 | 333,400 | -- |
| | SSJ03 | 100 | 92.5 | 4,558,000 | 0.1 |
| | SSJ04 | 100 | 92.5 | 4,843,450 | 1.6 |
| | SSJ07 | 100 | 95 | 4,833,950 | 0.4 |
| | SSJ10 | 100 | 92.5 | 5,160,475 | 0.7 |

* = Significantly different from control

## *Ceriodaphnia* Acute Phase I TIE on CS12 (6/13/05) Sample

| *Treatment* | *Concentration (%)* | *Cumulative Mortality on Indicated Day (%)*[a] | | | | *Comments* |
|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* | |
| Baseline | Control | 0 | 0 | 0 | 0 | 1.3 TUa[b] |
| | 6.25 | 0 | 0 | 0 | 0 | |
| | 12.5 | 0 | 0 | 0 | 0 | |
| | 25 | 0 | 0 | 0 | 0 | |
| | 50 | 0 | 0 | 0 | 0 | |
| | 100 | 5 | 20 | 100 | 100 | |
| EDTA (8 mg/L) | EDTA Control | 0 | 0 | 0 | 0 | 1.3 TUa |
| | 25 | 0 | 0 | 0 | 0 | |
| | 50 | 0 | 0 | 0 | 0 | EDTA did not prevent toxicity. |
| | 100 | 0 | 0 | 100 | 100 | Cationic metal toxicity not present. |
| Aeration | Aeration Control | 0 | 0 | 0 | 0 | 1.4 TUa |
| | 25 | 0 | 0 | 0 | 0 | |
| | 50 | 0 | 5 | 5 | 5 | |
| | 100 | 0 | 10 | 100 | 100 | Aeration did not prevent toxicity |
| C-8 SPE | Column Blank | 0 | 0 | 0 | 0 | 0 TUa |
| | 25 | 0 | 0 | 0 | 0 | |
| | 50 | 0 | 0 | 0 | 0 | SPE column removed all toxicity. |
| | 100 | 0 | 0 | 0 | 0 | Toxicity caused by non-polar organics |
| | MeOH Control | 0 | 0 | 0 | 0 | Toxicity partially recovered at 1X |
| | 1X Add-Back | 0 | 0 | 15 | 65 | |
| PBO | PBO Control | 0 | 0 | 0 | 0 | 0 TUa |
| | 6.25 | 0 | 0 | 0 | 0 | |
| | 12.5 | 0 | 0 | 5 | 5 | |
| | 25 | 0 | 5 | 5 | 5 | PBO prevented all toxicity. |
| | 50 | 0 | 0 | 0 | 0 | Metabolically-activated OP(s) caused all sample toxicity |
| | 100 | 0 | 0 | 0 | 0 | |

Test Date: 6/17/05

a Mean mortality of 4 replicates of 5 *C. dubia* neonates

b Acute Toxic Units (TUa) = $100/IC_{50}$

## *Ceriodaphnia* Acute Phase I TIE on CS23 (6/13/05) Sample

| *Treatment* | *Concentration (%)* | *Cumulative Mortality on Indicated Day (%)*[a] | | | | *Comments* |
|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* | |
| Baseline | Control | 0 | 0 | 0 | 0 | 5.3 TUa[b] |
| | 6.25 | 0 | 0 | 0 | 0 | |
| | 12.5 | 0 | 0 | 0 | 0 | |
| | 25 | 65 | 100 | 100 | 100 | |
| | 50 | 100 | 100 | 100 | 100 | |
| | 100 | 100 | 100 | 100 | 100 | |
| Settled Baseline | Control | 0 | 0 | 0 | 0 | 5.4 TUa[b] |
| | 6.25 | 0 | 0 | 5 | 5 | |
| | 12.5 | 0 | 0 | 0 | 0 | |
| | 25 | 5 | 100 | 100 | 100 | |
| | 50 | 100 | 100 | 100 | 100 | |
| | 100 | 100 | 100 | 100 | 100 | |
| EDTA (8 mg/L) | EDTA Control | 0 | 0 | 0 | 0 | > 4.0 TUa[c] |
| | 25 | 0 | 100 | 100 | 100 | |
| | 50 | 100 | 100 | 100 | 100 | EDTA did not prevent toxicity. |
| | 100 | 100 | 100 | 100 | 100 | Cationic metal toxicity not present. |
| Aeration | Aeration Control | 0 | 0 | 0 | 0 | > 4.0 TUa[c] |
| | 25 | 0 | 100 | 100 | 100 | |
| | 50 | 100 | 100 | 100 | 100 | Aeration did not prevent toxicity. |
| | 100 | 100 | 100 | 100 | 100 | |
| C-8 SPE | Column Blank | 0 | 0 | 0 | 0 | 0 TUa |
| | 25 | 0 | 0 | 0 | 0 | |
| | 50 | 0 | 0 | 0 | 0 | SPE column removed all toxicity. |
| | 100 | 0 | 0 | 0 | 0 | Toxicity caused by non-polar organics |
| | MeOH Control | 0 | 0 | 0 | 0 | Toxicity recovered at 1X |
| | 1X Add-Back | 100 | 100 | 100 | 100 | |
| Baseline + PBO | PBO Control | 0 | 0 | 5 | 5 | 0 TUa |
| | 6.25 | 0 | 0 | 10 | 10 | |
| | 12.5 | 0 | 0 | 10 | 10 | PBO prevented all toxicity. |
| | 25 | 0 | 0 | 5 | 5 | Metabolically-activated OP(s) caused |
| | 50 | 0 | 0 | 5 | 5 | all sample toxicity |
| | 100 | 0 | 0 | 0 | 0 | |

Test Date: 6/17/05

a Mean mortality of 4 replicates of 5 *C. dubia* neonates

b Acute Toxic Units (TUa) = $100/_{IC50}$

c Total mortality at lowest concentration – TUa calculated as > 100/lowest concentration

## *Ceriodaphnia* Acute Phase I TIE on SS05A (6/14/05) Sample

| *Treatment* | *Concentration (%)* | *Cumulative Mortality on Indicated Day (%)*[a] | | | | *Comments* |
|---|---|---|---|---|---|---|
| | | *1* | *2* | *3* | *4* | |
| Baseline | Control | 0 | 0 | 0 | 0 | > 21.3 TUa[b] |
| | 6.25 | 0 | 5 | 40 | 85 | |
| | 12.5 | 100 | 100 | 100 | 100 | |
| | 25 | 100 | 100 | 100 | 100 | |
| | 50 | 100 | 100 | 100 | 100 | |
| | 100 | 100 | 100 | 100 | 100 | |
| EDTA (8 mg/L) | EDTA Control | 0 | 0 | 0 | 0 | > 4.0 TUa[b] |
| | 25 | 100 | 100 | 100 | 100 | |
| | 50 | 100 | 100 | 100 | 100 | EDTA did not prevent toxicity. |
| | 100 | 100 | 100 | 100 | 100 | Cationic metal toxicity not present. |
| Aeration | Aeration Control | 0 | 0 | 0 | 0 | > 4.0 TUa[b] |
| | 25 | 0 | 100 | 100 | 100 | |
| | 50 | 100 | 100 | 100 | 100 | Aeration did not prevent toxicity. |
| | 100 | 100 | 100 | 100 | 100 | |
| C-8 SPE | Column Blank | 0 | 0 | 0 | 0 | 0 TUa[c] |
| | 25 | 0 | 0 | 0 | 0 | |
| | 50 | 0 | 0 | 0 | 0 | SPE column removed all toxicity. |
| | 100 | 0 | 0 | 0 | 0 | Toxicity caused by non-polar organics |
| | MeOH Control | 0 | 0 | 0 | 0 | Toxicity recovered at 1X |
| | 1X Add-Back | 100 | 100 | 100 | 100 | |
| Baseline + PBO | PBO Control | 0 | 0 | 0 | 0 | 1.2 TUa[c] |
| | 6.25 | 0 | 0 | 0 | 0 | |
| | 12.5 | 0 | 0 | 0 | 0 | PBO prevented some toxicity. |
| | 25 | 0 | 0 | 0 | 0 | Metabolically-activated OP(s) caused |
| | 50 | 0 | 0 | 0 | 0 | some sample toxicity |
| | 100 | 0 | 0 | 55 | 80 | |

Test Date: 6/17/05

a Mean mortality of 4 replicates of 5 *C. dubia* neonates

b Greater than 50% mortality at lowest concentration – TUa calculated as > 100/lowest concentration

c Acute Toxic Units (TUa) = $100/IC_{50}$

**Database development and management**

As specified in the contract between the Regional Board and UC Davis, Phase II Agricultural Waiver data is to be entered into a SWAMP compatible database. The AEAL database manager received SWAMP database training at Moss Landing Marine Laboratory including training on chemical data entry, toxicity data entry, database QA, lab template data entry and the data loader program. Following the training, the database for the Agricultural Waiver program was established creating and entering project ID's, lab/site codes and seasonal codes were created. A method for updating the analyte, equipment and site descriptions was created. This effort requires frequent contact and information transfer with the SWAMP data management team at Moss Landing to guarantee that the database is compatible with the SWAMP database. Quality Assurance data were inserted into the database together with the SWAMP Quality Assurance codes. In addition, data from the field sheets (site lat/longs, field descriptions, field parameters) were entered into the database. New field sheets were created for the Dormant Season sampling. Documents were created to aid the field crews in filling in the field sheets properly in the field and for entering this data into the database. Further preparation for the Dormant Season sampling included the creation of new site codes, new site descriptions as well as new equipment codes. For laboratories that are entering the data into the SWAMP template, a sample detail sheet was created and sent to each lab that included SWAMP-specific codes corresponding to each sampling event. Aquascience personnel were trained in how to enter toxicity results into the SWAMP template and new approaches have been conceived to help the lab get the data in the template as quickly as possible. AEAL personnel entered data from the field sheets into the database maintained at UC Davis. Eventually the database will be turned over to the Central Valley Regional Water Quality Control Board.